

**Engineering Maths – III [EM-III]**  
S.E. Sem. III [BIOM/INST/ELEC]

**EVALUATION SYSTEM**

|                                  | <b>Time</b> | <b>Marks</b> |
|----------------------------------|-------------|--------------|
| <b>Theory Exam</b>               | 3 Hrs.      | 100          |
| <b>Practical &amp; Oral Exam</b> | –           | –            |
| <b>Oral Exam</b>                 | –           | –            |
| <b>Term Work</b>                 | –           | –            |

**SYLLABUS**

**1. Laplace Transform**

Functions of bounded variations.

Laplace Transforms of  $1, t^n, e^{at}, \sin at, \cos at, \sinh at, \cosh at, \operatorname{erf}(t)$  Linear property of L.T. First shifting theorem, Second shifting theorem,

$$L\{t^n f(t)\}, L\left\{\frac{f(t)}{t}\right\}, L\left\{\int_0^t f(u)du\right\}, L\{f^n(t)\}$$

Change of scale property of Laplace Transforms Unit step function, Heavy side, Dirac delta functions, Periodic functions and their Laplace Transforms.

**(a) Inverse Laplace Transforms :** Evaluation of inverse L.T., partial fractions method, convolution theorem.

**(b) Applications** to solve initial and boundary value problems involving ordinary differential equation with one dependant variable.

**2. Complex Variables**

Functions of complex variables, continuity and derivability of a function, analytic functions, necessary condition for  $f(z)$  to be analytic, sufficient condition (without proof), Cauchy-Riemann conditions in polar forms. Analytical and Milne-Thomson method to find analytic functions  $f(z) = u + iv$  where (i)  $u$  is given (ii)  $v$  is given (iii)  $u + v$  (iv)  $u - v$  is given. Harmonic functions and orthogonal trajectories.

**(a) Mapping :** Conformal mapping, Bilinear mapping, fixed points and standard transformation, inversion, reflection, rotation and magnification.

**(b) Line Integral** of function of complex variable, Cauchy's theorem for analytical function (with proof), Cauchy's Goursat theorem (without proof), properties of line integral, Cauchy's Integral formula and deduction.

**(c) Singularities and poles :** Taylor's and Laurent's development (without proof), residue at isolated singularity and it's evaluation.

**(d) Residue theorem** application to evaluate real integrals of type

$$\int_0^{2\pi} f(\cos \theta, \sin \theta) d\theta \quad \text{and} \quad \int_{-\infty}^{+\infty} f(x) dx$$

**3. Fourier series**

Orthogonality and orthogonal functions, Expression for the function in a series of orthogonal functions. Dirichlet's conditions, Fourier series of periodic functions with period  $2\pi$  or  $2l$ . (Derivation of Fourier coefficients  $a_0, a_n, b_n$  is not expected) Dirichlet's theorem Even and Odd functions. Half range sine and cosine expressions Parsaval's identities (without proof).

**(a) Complex form of Fourier Series :** Fourier transform and Fourier integral in detail.

**Reference :**

1. Textbook of Applied Mathematics (*Wartikar P.N., Wartikar J.N.*) Pune Vidyarthi Griha Prakashan, 1981.
2. Advanced Engineering Mathematics (*Kreyszig Erwin*) Wiley Student Edition – New Delhi, 2006 (8<sup>th</sup> Edition).
3. Complex Variables (*Churchil*) McGraw Hill.
4. Theory of Function Complex Variable (*Shantinakaran*) S. Chand & Co.
5. Engineering Mathematics (*Shastri S.S.*) Prentice Hall.
6. Advanced Modern Engineering Mathematics (*Glyn James*) Pearson Education Ltd., 2004 (3<sup>rd</sup> Edition)

